Quest Journals
Journal of Research in Mechanical Engineering
Volume 10 ~ Issue 2 (2024) pp: 01-08
ISSN(Online):2321-8185
www.questjournals.org

Research Paper

Development of Practical Skills Assessment Scale For Metal Cutting In Technical Colleges In Nigeria

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Abstract
This study development of practical skills assessment scale for metal cutting in technical colleges in Nigeria (MCPSAS) to improve students' performance in metal-cutting practical skill processes. The study answered three research questions and tested two hypotheses. The MCPSAS comprising of practical skills based on the National Business and Technical Examinations Board (NABTEB) curriculum and related literature was developed and validated by five experts in Ebonyi State University Abakiliki. The study adopted an instrumentation design and was carried out in two geo-political zones South- East and North-East of Nigeria. The population of the study was 492 Metalwork students. The sample size was 48 metalwork students selected from 12 Technical Colleges. The instrument for data collection was entitled Metal Cutting Practical Skills Assessment Scale MCPSAS. The reliability of the instrument was established using Kendall coefficient concordance and this yielded a reliability coefficient of 0.89. Data for the study was collected by personal contact with the respondents with the help of research assistants. Data were analyzed using factor analysis, statistical mean and standard deviation for the research question, and t-test at 0.05 level of significance for the hypotheses. The result of the study showed that seven clusters and 75 practical skills were found appropriate for the MCPSAS. Based on this result, it was recommended amongst others that metal cutting practical skill assessment scale is appropriate for Technical Colleges and other similar institutions in Nigeria should be made to be aware and learn to use the MCPSAS for assessing performance in metalwork practical skills processes in Technical Colleges

Keywords: *assessment scale; practical skill; metal cutting. Process skills*

***R**eceived 09 Feb., 2024; **R**evised 22 Feb., 2024; **A**ccepted 24 Feb., 2024 © The author(s) 2024.*
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I. Introduction

Technical College is one of the principal vocational institutions that provide technical education in Nigeria, charged with the responsibility of imparting necessary skills that lead to the production of craftsmen and technicians who are expected to be skilled and self–reliant in the world of work. The skill-oriented and performance-based programs allow effective training and assessment of craftsmen in a wide range of trades that help students achieve various instructional objectives in the different domains of learning (Okwelle and Okoye, 2012). Technical College education centers around the performance in the psychomotor domain with relevant emphasis on cognitive and affective domains (FGN 2004 and NBTE 2007). Technical College is viewed as an institution where vocational training is given to students. These skills will enable them to gain entry into various occupations like Automobile, Electrical/Electronic, and Mechanical Engineering Craft Epenyong (2011). Macdelyn Mosalagae & Bekker,(2021) defined Technical College as the principal vocational institution that gives vocational training intended to prepare students for entry into various occupations as craftsmen and technicians. Both definitions are geared towards training for skill acquisition in different occupations. Hence, a Technical College can be described as an institution where students are trained in various occupations to acquire employable skills that will enable them to function well in the occupation in the world of work. By implication, much attention is focused on psychomotor performance or practical learning. The psychomotor component requires the appropriate use of workshop tools, equipment, and training materials that are necessary for effective

training of the craftsman in his / her chosen trade such as Automobile, Electrical/Electronic, and Metalwork Mechanical Engineering Craft, among others.

Metalwork technology is one of the technical courses studied in Technical Colleges in Nigeria. Metalworking is a science, art, craft, and trade. According to Anya and Kelly (2017), metalwork technology is one of the courses in technical colleges that are aimed at training skilled labor for self-reliance. Metalwork technology is a field of study that teaches individuals how to make use of metal to produce different products for daily needs. Danjuma and Umaru (2019) stated that Metalwork Technology is the activity of making objects/products out of metals. Metalwork is generally called Metalwork Technology because it involves modern ways of making metal products using different tools, equipment, and machines. Ombugus (2013) opined that the aim of the Metalwork technology curriculum at the Technical College level is to teach the learner how to practice the trade independently upon graduation. Okeme (2011) defined metalwork technology as the study of all aspects of metalworking such as bench, sheet, art, metal jewelry, metal finishing, forging, casting, machines, heat treating, material testing, welding, and other fasting methods in metal manufacturing. In this context, metalwork technology involves the study where metals are redesigned and reconstructed for modern objects used at home and the industries. Ruth Cardoso Rocha et al.,(2023) stated that metalwork craftsmen are involved among others in the following operations: manipulating complex tools and equipment; determining and selecting appropriate metals; determination and committing to obeying safety rules guiding the complex machines they are working with.

Metalwork studies aim to produce skilled craftsmen for self or paid employment in the world of work. In the metalwork curriculum, there are some operations/tasks enumerated in metal cutting operations. According to the National Board for Technical Education (NBTE, 2013) metalwork process involves complex tasks. Such tasks are taught in step-by-step procedures to enable students to acquire the required skills for machine operation. According to Anya (2015), the step-by-step procedure will facilitate their rate of acquisition of practical skills.

Skills acquisition is one of the surest ways through which young people can find their way into the labor market either in the public or private sectors. Jing et al., (2023) defined skill as the ability to perform expertly and facilitate performance during employment. Matsumoto et al (2022) note that skill is an individual capability to control elements of behavior, thinking, and feeling within specified content and particular task domain. Advances in technology have rendered metalwork skills inadequate for work in the metal process industry; while creating needs for new and often sophisticated skills. This is because metal products are coming with new devices as a result of technological advancements. (Lima et al., 2023) With the seemingly rapid growth in metal users in Nigeria today, there is a need to improve the skills of the workforce needed for the metal industry.

The popular method of assessing students' practical skills in Technical Colleges including metal cutting practice trade by their teachers and instructors in Nigerian Evidence from research studies (Abeles et al., 2023) (Lars Mommers et al., 2023); Adio,. 2014) Okwelle, 2003) indicates that is based on mere looking at the students' finished products with little or no attention to the process involved in carrying out the practical work. Marks are then awarded to the students based on what the teacher or examiner feels the student deserves. This observatory method of awarding marks to students is considered biased and subsumes the award of grades that show individual examiner's feelings. According to Ali (2006) the reason for this lopsided practice of assessment by the teachers could be that they are either reluctant, background, or too busy to assess the various stages of individual students' work by at least preparing a definite procedure of assessment.

To improve the standard of assessment in technical and vocational education, there is a need to use valid and reliable assessment instruments that will take into account the process of practical activities leading to the completion of the final practical products. Though such instruments have been developed in some other technical and vocational trades (Bukar, 2015, 2006; Chiejile, 2006; Adio,. 2014).; Okeke, 2004; Yalams, 2005), literature available to the researcher indicates that no such instrument has been developed and validated for use in metal cutting practical skill processes in Technical Colleges. Against the background of the paucity of standard instruments for assessing practical skills in metal-cutting operations, trade prompted the development of practical skills assessment scale for metal cutting in Technical Colleges in Nigeria

Statement of the Problem

Metalwork technology as a skill-oriented field of study is expected to equip learners with saleable skills that make way for self-reliance and paid employment. Poor performance of students in metalwork technology has made most Technical College school leavers to be unable to gain admission into higher institutions due to their inability to make at least a credit in the subject in the National Board for Technical Education Examinations (NABTEB). The Chief Examiner's reports for 2018 and 2019 stated that many candidates recorded poor achievement in metalwork technology in their practical results. It is also the observation of the West African Examination Council (Technical) Chief Examiner 2019 and National Examination Council 2018

that students do not know how to carry out practical work in the workshops, especially in the area of metal cutting. According to examiner reports students perform below credit level in their external examinations. The students might have had poor assessments that led to poor mastery of the skills in drilling, reaming, facing, turning, boring, milling, and broaching in metalwork technology processes. The extent of mastery in skill attainment in a competency-based subject like metal work trade is ascertained through a competency-based assessment process.

However, it has been revealed from research studies that graduates of metalwork technology from Technical Colleges are unable to perform as expected in their occupational trades. This situation could be attributed to various factors which include; the wrong method of assessing the skills of the students of metalwork technology. Furthermore, less attention has been given to the influence of school proprietorship on students' practical skill acquisition. The three types of proprietorship of Technical Colleges; include private Technical Colleges, State Technical Colleges, and Federal Technical Colleges. However, the study examines the extent of State and Federal Technical Colleges' influence on students' assessment in practical skill acquisition on metal cutting practices in the metalwork trade. The influence of gender has become necessary in assessing students' practical skills due to the nature of metal cutting practices in metalwork technology, to clarify the gender differences in metal cutting practice skills irrespective of location. The location of the school is attributed to students' skill acquisition in metal-cutting practice.

The National Technical Certificate (NTC) and the Advanced National Technical Certificate (ANTC) examination conducted by NABTEB for assessing metalwork technology are focused more on the assessment of knowledge (cognitive) neglecting the process skills (psychomotor) and the whole affective (attitude). This assessment process has made the metalwork graduates lack sufficient skills resulting in a lack of saleable skills, unemployment, and lack of self-reliance in metal cutting practice work. This study, therefore, seeks to development of practical skills assessment scale for metal cutting in Technical Colleges in Nigeria

Purpose of the Study

The main purpose of the study is to develop metal metal-cutting practical skills assessment scale in Technical Colleges in Nigeria. Specifically, the study will seek to:

1. validate metal cutting practical skill assessment scale
2. test reliability of the metal cutting practical skill assessment scale
3. Find out the influence of location on the mean rating of the student's practical skills

Research Questions

The following research questions were formulated to guide the study

1. What are valid metal-cutting practical skill assessment scales?
2. What reliability of the metal cutting practical skill assessment scale?
3. How does location influence the mean rating of the student's practical skills?

Hypotheses

The null hypothesis which was formulated to guide the study was analyzed at a 0.05 level of significance.

1. H_0: There is no significant difference in the mean ratings of the Metal Cutting Practical Skill Assessment Scale (MCPSAS) in metalwork technology between Urban and Rural students in Technical Colleges.

II. METHODOLOGY

The study is an instrumentation research design. Instrumentation research design is used for a study if the purpose of the study is to produce new or modified content, procedures, technologies, or instruments for educational practices. The study answered three research questions and tested two hypotheses. The MCPSAS comprising practical skills based on the National Business and Technical Examinations Board (NABTEB) curriculum and related literature was developed and validated by five experts at Ebonyi State University Abakiliki. The study adopted an instrumentation design and was carried out in two geo-political zones South-East and North-East of Nigeria. The population of the study is 492 Metalwork practice technical students. The sample size of the study was 48 metalwork technology students selected from the 12 Government Technical Colleges selected from each geo-political zone of Nigeria (seven State Technical Colleges and five Federal Technical Colleges). The sampling method was a purposeful sampling technique. This was to enable the researcher to select the metalwork practice students purposefully from the sampled Technical Colleges. Data were analyzed using factor analysis, statistical mean and standard deviation for the research question, and t-test at 0.05 level of significance for the hypotheses. The instrument used for this study is the Metal Cutting Practical Skill Assessment Scale (MCPSAS). The draft copy of the instrument has a total of 79 items which were designed to assess the following practical skills in metal cutting processes; Lathe turning, Milling, Facing,

Drilling, Reaming, Boring, and Broaching Operations in Technical Colleges. Following a detailed review of relevant literature and the NABTEB curriculum, which awards the Nigeria National Technical Certificate (NTC), the instrument was arranged into seven clusters. The developed MCPSAS was based on a point scale namely: Very Highly Appropriate (VHA), Highly Appropriate (HA), Moderately Appropriate (MA), Appropriate (A), and Inappropriate (IA). These levels of responses were weighted as 4, 3, 2, 1, and 0 respectively to form parts of MCPSAS. Also, an operational scoring guide was attached to assist the Raters / Teachers in their assessments. Face validation of the draft instrument was carried out by five experts; three in the Technology and Vocational Education Department Ebonyi State University, one expert from the Measurement and Evaluation Unit of Science Education, and one expert from Metal Work Technology, Faculty of Vocational and Technical Education, University of Nigeria, Nsukka. Following the comments of these experts, a final instrument consisting of 75 items was finally drafted and used for the study. To determine the reliability of the instrument, a pilot testing of the draft copies of the instrument was administered to 12 Metalwork Students in the North-Central zone of Nigeria which consist of Niger, Kwara, Kogi, Benue, Plateau, and Nasarawa States that are outside the study area. The responses of these metalwork students were scored and subjected to factor analysis. The items that did not meet the specifications in terms of minimum loading were dropped out of the seventy-nine items that were subjected to a preliminary validation exercise. Four items failed to attain a minimum loading of 0.35 on any of the seven factors. Kendal coefficient concordance was used to test the degree of reliability of each of the operations and the entire instruments, which yielded 0.89. This was considered reliable and adequate for academic research. To answer research question 2, Kendal's coefficient of concordance was used to test the degree of reliability of each of the operations and the entire instrument. T-test was used in testing hypotheses 1, and 2, which guided the study. This was tested at a 0.05 level of significance. For selecting the practical skills appropriate for inclusion in the Metal Cutting Practical Skills Assessment Scale (MCPSAS) a mean cut of 2.50 and above was utilized. Therefore, any practical skill with a mean score of 2.50 and above was considered appropriate and chosen while a practical skill with a mean score below 2.50 was considered inappropriate to be included in the developed instrument for testing the hypothesis, t- a test was used at a 0.05 level of significance. That means if the calculated value is more than the critical value, the hypothesis is rejected, but when the calculated value is less than the critical value the hypothesis is upheld.

III. RESULTS AND DISCUSSIONS

Research Question 1: What are valid metal-cutting practical skill assessment scales?

Table 1: Factor Loadings Summary of Means, and Standard Deviations of the Seven Metal Cutting Practical Skill Assessment Scale in Technical Colleges in Nigeria N = 48

Metal Cutting Practical Skills Assessment Scales		Factor DOS1	LTO2	MOS3	FOS4	BOS5	ROS6	BOS7	$\bar{X}$	SD
DOS1-10	Drilling Operation Skills	.951							2.97	0.48
	Cronbach's alpha	.867								
	KMOMSA	.714								
LTO11-25	Lathe Turning Skills		.753						3.06	0.46
	Cronbach's alpha		.645							
	KMOMSA		.833							
MOS26-40	Milling Operation Skills			.717					3.02	0.29
	Cronbach's alpha			.473						
	KMOMSA			.479						
FOS41-48	Facing Operation Skills				.788				3.07	0.50
	Cronbach's alpha				.549					
	KMOMSA				.719					
BOS50-56	Boring Operation Skills					.853			3.01	0.28
	Cronbach's alpha					.640				
	KMOMSA					.862				
ROS57-65	Reaming Operation Skills						.780		3.04	0.36
	Cronbach's alpha						.749			
	KMOMSA						.780			
BOS66-75	Broaching Operation Skills							.751	3.18	0.35
	Cronbach's alpha							.823		
	KMOMSA							.788		
	Overall Cronbach's alpha							**0.68**	**3.05**	**0.39**

Extraction Method: Principal Component Analysis; KMOMSA = Kaiser–Meyer–Olkin Measure of Sampling Adequacy.

Table 1 presents the summary of the factor loadings of the practical skill assessment scale in metal cutting processes in Technical Colleges in Nigeria. The results showed homogeneity of item spread. However,

out of seventy-nine items of the MCPSAS subjected to factors analysis, four items (i.e., items 5, 12, 58, and 60) did not load properly and were discarded, thus leaving 75 items. According to Ogbonna in Obe (2019), for an item to be accepted in any factor it has to attain a loading of up to 0.35. For the drilling operation skills its validity was determined using 2scales: agree (1) and disagree (0). This section consists of 10 items describing different drilling operation skills. The items were subjected to principal components analysis (PCA). PCA is considered suitable for this analysis because it helps researchers who are interested in scale and wish to generate an empirical summary of any given data set (Tabachnick, & Fidell, 2001). More than 90% of the respondents agreed that each of the items is drilling operation skills required in Technical Colleges in Nigeria. The metalwork technology students (more than 70%) also affirmed that all the items identified as the lathe turning and milling operation skills are metal cutting operating skills required in Technical Colleges in Nigeria and that these skills are capable of improving their metalwork practice and also improve their performance. From the factor loading results, about 78%, 85%, 78%, and 75% agree that the items identified as facing, boring, reaming, and broaching operation skills respectively are metalwork cutting practical skill assessment scales required in Technical Colleges in Nigeria. Furthermore, results presented in Table 1 also indicated a positive value of Kaiser–Meyer–Olkin Measure of Sampling Adequacy (KMO) and the result showed a grand value of .714, .833, .479, .719, .862, .780, and .788 respectively. These results are congruent with Lars Mommers,et al (2023) who noted that for factor analysis to be considered appropriate for data analysis, the KMO value must be .6 and above. Factor analysis is considered fit for this study because it permits a researcher to ascertain if many variables can be described by a few factors (Fraenkel & Wallen, 2009).

Research Question 2: What are the reliable Metal Cutting Practical Skills Assessment Scale (MCPSAS) in Technical Colleges?

Table 2: The result of the reliability of the metal cutting practical skills assessment scale using Kendal coefficient of concordance Tau (w) are given below:

S / N	TASK / OPERATION	N0 OF ITEMS	Kendal coefficient of concordance Tau (w)	REMARKS
1	Drilling Operation	10	0.65	A
2	Lathe Turning Operation	15	0.80	A
3	Milling Operation	15	0.80	A
4	Facing Operation	8	0.45	A
5	Boring Operation	8	0.45	A
6	Reaming Operation	9	0.50	A
7	Broaching Operation	10	0.65	A
	Average (W)		0.614	A

Key: A=Appropriate.

Table 2: revealed that each of the seven major tasks/operations has a high-reliability co-efficient. Also, the result of the analysis revealed that 75 items of the instrument were highly reliable for inclusion in the final copy of the instrument. The obtained Tau (w) for the various clusters ranged between 0.45 and 0.80. And that of the entire instrument was found to be 0.61. The developed instrument was found to be valid, reliable, and practically useful for assessing metal cutting practical skills in Technical Colleges.

Research Question 3: What is the influence of location on the mean rating of the student's practical skills?

Table 3: Mean and Standard Deviation Ratings on the Influence of Location on the Student Practical Skills in Technical Colleges N = 48

S/N	Items	Urban		Rural		Remark
		$\bar{X}$	SD	$\bar{X}$	SD	
1	Taking measurement	2.80	0.30	3.12	0.56	A
2	Setting- up the drilling machine	3.01	0.30	3.11	0.57	A
3	Drilling a hole in a metal bar	3.02	0.34	3.02	0.25	A
4	Drilling a blind hole in a metal	2.84	0.31	3.27	0.56	A
5	Spot drilling	2.97	0.29	3.06	0.28	A
6	Make chain drill	2.96	0.33	3.11	0.37	A
7	Use the appropriate clamping device	3.00	0.27	3.34	0.34	A
8	Handling vibrating drilling machine	2.94	0.30	3.15	0.42	A
9	Counter sunk drilling	2.80	0.30	3.12	0.56	A
10	Counter sink drilling	3.01	0.30	3.11	0.57	A
	Cluster mean	**3.02**	**0.34**	**3.02**	**0.25**	**A**

Key: $\bar{X}$ = Mean, SD = Standard Deviation, A = Appropriate.

The result presented in Table 3 showed the mean ratings of the respondents on the influence of location on metal-cutting practical skills. The result revealed that items 1 to 10 in Technical Colleges in the Urban area had mean values ranging from 2.80 to 3.01 with corresponding standard deviations ranging from 0.27 to 0.34

indicating that the metal technology students in the Urban area agree that the 10 items identified as the metal cutting practical skills are the skills, they require for effective metal cutting. Similarly, the results from the Technical Colleges in Rural areas revealed mean values ranging from 2.02 to 3.34 with corresponding standard deviation ranging from 0.25 to 0.57 indicating that all the respondents agree that these skills are needed for metal cutting practical. The overall standard deviations of 0.34 and 0.25 indicate that the respondents in the Urban and Rural Technical Colleges are very close to one another in their opinions.

Hypothesis 1:

H_{O1}: There is no significant difference in the mean ratings of the Metal Cutting Practical Skill Assessment Scale (MCPSAS) in metalwork technology between male and female students in Technical Colleges

Table 4: t-test Summary of Metal Cutting Practical Skills in Metalwork Technology between Male and Female Students in Technical Colleges in Nigeria N (Male = 32, Female = 16)

S/N	Operations Skills	Male		Female		Df	t-cal	Sig. 2-tailed	Remk
		$\bar{X}m$	SD	$\bar{X}f$	SD				
1	Drilling	3.05	1.01	2.93	0.97	46	0.461	0.832	NS
2	Lathe Turning	3.10	0.88	3.04	1.00	46	0.196	0.505	NS
3	Milling	3.03	0.93	3.01	0.92	46	0.138	0.299	NS
4	Facing	3.02	1.02	3.09	0.99	46	-0.48	0.877	NS
5	Boring	3.06	0.85	2.99	0.95	46	0.851	0.889	NS
6	Reaming	2.97	1.01	3.08	1.00	46	-1.01	0.229	NS
7	Broaching	3.20	0.96	3.17	0.97	46	0.081	0.320	NS
	Cluster Mean	**3.06**	**0.95**	**3.04**	**0.97**	**46**	**0.034**	**0.564**	**NS**

Key: $\bar{X}$= Mean, SD = Standard Deviation, Df = Degree of freedom, Remk = Remarks, S = Significant, NS = Not significant.

Table 4 presents a t-test summary to test hypothesis 1 that there is no significant difference in the mean responses of male and female students on the Metal Cutting Practical Skill Assessment Scale (MCPSAS) in metalwork technology in Technical Colleges in Nigeria. Results revealed P-values on the operating skills items which ranged from 0.299 – 0.889 with overall cluster means of p = 0.564, t-cal of 0.034 at 46degree of freedom. Since each of the overall P-values is greater than 0.05 criterion values, it implies that there was no significant difference in the mean responses of the respondents. Therefore, the hypothesis 1 of no significant difference was not rejected.

Hypothesis 2

H_{03}: There is no significant difference in the mean ratings of the Metal Cutting Practical Skill Assessment Scale (MCPSAS) in metalwork technology between Urban and Rural students in Technical Colleges.

Table 5: t-test Summary of Metal Cutting Practical Skills in Metalwork Technology between Urban and Rural Technical Colleges in Nigeria N (Urban = 25, Rural = 23)

S/N	Operations Skills	Urban		Rural		Df	t-cal	Sig. 2-tailed	Remk
		$\bar{X}m$	SD	$\bar{X}f$	SD				
1	Drilling	2.80	0.30	3.12	0.56	46	-2.48	0.053	NS
2	Lathe Turning	3.01	0.30	3.11	0.57	46	-0.72	0.030	S
3	Milling	3.02	0.34	3.02	0.25	46	0.016	0.167	NS
4	Facing	2.84	0.31	3.27	0.56	46	-3.25	0.121	NS
5	Boring	2.97	0.29	3.06	0.28	46	-1.07	0.659	NS
6	Reaming	2.96	0.33	3.11	0.37	46	-1.46	0.419	NS
7	Broaching	3.00	0.27	3.34	0.34	46	-3.86	0.163	NS
	Cluster Mean	**2.94**	**0.30**	**3.15**	**0.42**	**46**	**-1.83**	**0.053**	**NS**

Key: $\bar{X}$= Mean, SD = Standard Deviation, Df = Degree of freedom, Remk = Remarks, S = Significant, NS = Not significant.

Table 5 shows a t-test summary of hypothesis 3 that there is no significant difference in the mean responses of the Metal Cutting Practical Skill Assessment Scale (MCPSAS) in metalwork technology among

students in Federal and State Technical Colleges. Results show P-values on all the operating skills which ranged from 0.030 – 0.659 with overall cluster means of p = 0.053, t-cal of -1.83at 46degree of freedom. Since each of the overall P-values except that of item 2 is greater than 0.05 criterion values, it implies that there was no significant difference in the mean responses of the respondents from urban and rural locations on MCPSAS of the metalwork technology in Technical Colleges in Nigeria. Therefore, the hypothesis 3 of no significant difference was not rejected.

IV. Conclusion

The study set out to develop and validate the metal cutting practical skill assessment scale for assessing practical skills in mechanical engineering craft students in Technical Colleges. The study successfully developed a valid and reliable test instrument for assessing the practical skills of students in the metalwork trade in technical colleges. The result related to the research question indicated that all 75 practical skills were considered appropriate for inclusion in the metal cutting practical skill assessment scale (MCPSAS). This signifies that the mechanical engineering craft studies trade teachers in technical colleges considered the 75 skill activities as appropriate for use in assessing students' performance in practical areas of the metalwork trade. Technical Colleges in Nigeria are set up to equip youths in different trades, either paid or self-employed. This study on metal works skills required by students of Technical Colleges for self-employment in Nigeria is a result of the technical manpower in the 21st-century labor market demands which have caused many metalwork graduates with various certificates to be unemployed. For Nigeria to rise above the problem of unemployment among metalwork Technical College students there is a need to impart sound metal-cutting practical skill processes as this will help them to be self-employed without necessarily waiting for white-collar jobs.

V. Recommendations

From the data collected and analyzed, the following recommendations are made;

1. The examination bodies in charge of conducting and organizing examinations for the Technical Colleges (NABTEB) should integrate the competency-based assessment instrument in their examination for certification of students in metalwork in Technical Colleges.
2. The NBTE should integrate the developed competency-based assessment instrument into the curriculum of Technical Colleges for training metalwork students.
3. The Nigerian Educational Research and Development Council should integrate the Developed competency-based assessment instrument into the vocational curriculum of Technical Colleges.

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